We claim:

1. A continuous process for separating a mixture of hydrocarbons which has been obtained by extractive distillation of a C_4 fraction (C_4) using a selective solvent (LM) and comprises the hydrocarbons from the C_4 fraction (C_4) which are more readily soluble in the selective solvent (LM) than are the butanes and the butenes, which comprises feeding the mixture into a first distillation column (K I) in which it is separated into a stream (K I-K) which is taken off at the top and comprises 1,3-butadiene, propyne, possibly further low boilers and possibly water and a bottom stream (K I-S) comprising 1,3-butadiene, 1,2-butadiene, acetylenes and possibly further high boilers, with the proportion of 1,3-butadiene in the bottom stream (K I-S) from the distillation column (K I) being regulated in such a way that it is at least sufficiently high to dilute the acetylenes to outside the range in which there is a risk of spontaneous decomposition, and passing the stream (K I-K) taken off from the top of the first distillation column (K I) to a second distillation column (K II) and separating it into a stream (K II-K) which is taken off at the top and comprises propyne, possibly further low boilers and possibly water and a bottom stream (K II-S) comprising pure 1,3-butadiene in the second distillation column (K II).

2. A process as claimed in claim 1, wherein the proportion of 1,3-butadiene in the bottom stream (K I-S) from the distillation column (K I) is regulated in such a way that the proportion of acetylenes in the bottom stream (K I-S) is less than 30 mol%.

3. A process as claimed in claim 1, wherein the bottom stream from the first distillation column (K I) and the stream from the top of the second distillation column (K II) are fed to a reactive distillation (RDK) column in which a selective hydrogenation of the hydrocarbons containing triple bonds to hydrocarbons containing double bonds is carried out by means of hydrogen in the presence of a heterogeneous catalyst, with partial conversion of the acetylenes, to give a stream comprising 1,3-butadiene, butanes, butenes and hydrocarbons containing triple bonds which have not been hydrogenated at the top and a bottom stream comprising high boilers which is discharged.

4. A process as claimed in any of claims 1 to 3, wherein the stream (RDK-K) taken off at the top of the reactive distillation column (RDK) or a substream thereof is recycled to the extractive distillation.